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The Saratoga Spittlebug

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The Saratoga spittlebug (*Aphrophora saratogensis* (Fitch)), so called because it was first collected in Saratoga County, N.Y., is a native insect and was described over 100 years ago. It has been reported coast to coast—in southern Canada and the northern United States, south into the east Central States and Florida, and also in California. It has been a major pest of red pine and jack pine plantations in Michigan and northern Wisconsin since 1941, when many young plantations were so severely damaged as to be considered failures. Since chemical suppression was begun in 1946, more than 100,000 acres of plantations of all ownerships in Michigan and Wisconsin have been sprayed.

Hosts

Red pine is the preferred host of the adult spittlebug. Jack pine follows, although decreased planting of this species in recent years has lessened its importance as a host. White pine is frequently fed upon but seldom damaged severely. Adults thought to be *Aphrophora saratogensis* have been collected from branches of pitch pine, tama-

rack, balsam fir, and northern white-cedar—usually from trees near infested red pine.

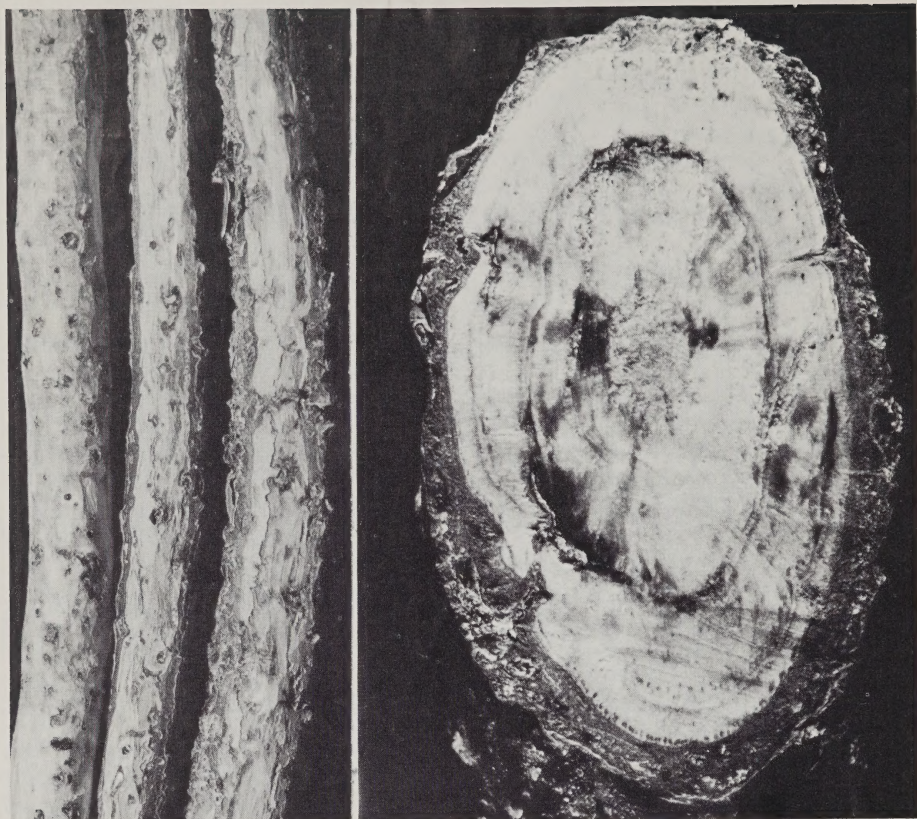
The nymphs require alternate hosts for their development. The early instars are commonly found on herbaceous species such as everlasting aster and ragwort, whereas the later instars prefer woody plants such as sweetfern, brambles, orange hawkweed, prairie willow, and aspen sprouts.

Damage

Damage is usually limited to trees between 2 and 15 feet tall, although larger trees are attacked. Signs of injury are: (1) reddish-brown "flags" in part or all of the crown in the spring; (2) numerous tiny punctures on the twigs (fig. 1), most abundant on the 1-year-old growth (the 2-year-old internodes) and often covered with droplets of resin; and (3) light tan or brownish flecks on the surface of the wood and the inner bark where the punctures occur—visible when the bark is removed.

Severely injured twigs have dead areas that are sometimes dark and usually infiltrated with resin. These are symptoms of the feeding activities of the adults and, in the early years of the infestation on jack pine, of the presence of the burn-blight fungus (*Chilonectria cucurbitula* (Curr.) Sacc.), which enters through the feeding punctures and hastens twig mortality. On red pine

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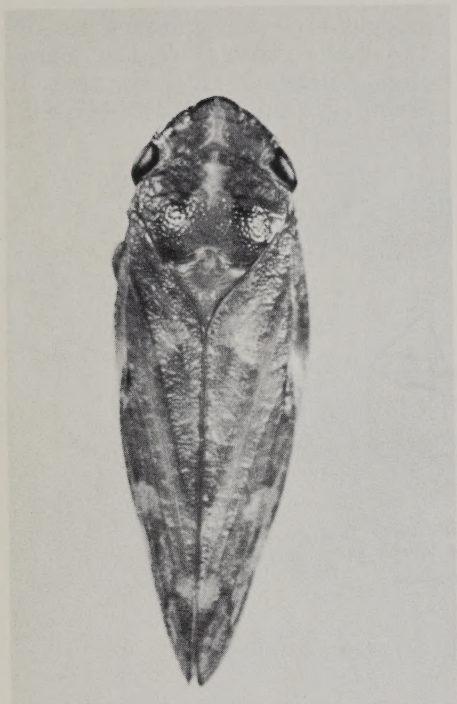
Figure 1.—*Saratoga spittlebug* damage: *Left*, Scars from adult feeding-punctures on pine twigs; *right*, cross section of a pine twig showing scar tissue in early growth layers.

the fungus is only weakly pathogenic, and the burn-blight condition apparently does not develop in sprayed plantations. The affected parts are killed by sap withdrawal by the insect and blocking of the conducting tissue caused by resin infiltration around the punctures. The foliage usually drops from the attacked branches within a year and a half.

Description

The adult is winged and about 1 centimeter long (fig. 2); the female is slightly larger than the male and

distinguished by its swordlike ovipositor. The base color is brown with tan to silvery-white markings—like a red pine twig. The egg, about 2 millimeters long, is shaped like an elongated teardrop, and is glistening yellow to purple. The nymphs range from 2 millimeters when hatched to 8 millimeters just before transformation to the adult stage. The most striking characteristic in the first four stages is the scarlet abdomen, bordered by black at the sides and contrasting sharply with the jet black head and thorax. In its fifth or last stage the nymph is uniformly dark brown.



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Figure 2.—Adult Saratoga spittlebug

Life History and Habits

There is one generation annually, and the insect overwinters in the egg stage. On red pine the eggs are laid under the outer scales of buds in the upper branches (fig. 3). Usually several are laid in each bud, causing a noticeable irregularity on the outer surface of the bud scales. On jack pine the eggs are laid in the needle sheaths; apparently the buds are too hard and resinous for this use.

In the Lake States, hatching is usually completed by mid-May, and the young nymphs drop or are blown to the ground, crawl to their host plants, and begin to feed, usually in groups. As they feed, they form the characteristic spittlemass which prevents their desiccation (fig. 4). The young nymphs feed on several herbaceous plant species and in their fourth and fifth stages many migrate to sweetfern and brambles (raspberry and blackberry). There is evidence that severe damage will



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Figure 3.—Eggs inserted between scales of red pine bud.



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Figure 4.—Spittlemass formed by nymphs at base of sweetfern.

seldom occur in a plantation unless (1) at least one of these early host species is present, (2) plant density averages at least one per square foot, and (3) the late-instar nymphs average one or more per plant. When they have finished feeding, the fully grown nymphs leave the spittlemasses, climb to the upper parts of their host plants, and transform to the adult stage. Depending on weather conditions, the nymphal period varies from 40 to 70 days.

The adults fly to the pine hosts and feed on the needle-bearing twigs. They are strong fliers and, when disturbed, dart from the twigs at such speed that the direction of flight may not be noticed. They are active from late June to the end of September, but peak activity is from mid-July to mid-August, when approximately 90 percent of the feeding damage occurs. Mating occurs soon after transformation, and the peak of egg laying is reached within 3 weeks.

Natural Control

Adverse weather occasionally kills spittlebugs. The nymphs are particularly susceptible to desiccation during dry hot weather, especially in open stands where ground cover is lacking. During late spring, short periods of air temperatures in the low 20's (°F.) and longer periods of 30° F. are highly destructive to exposed nymphs. Nymphs feeding on plants covered by forest litter are usually well protected.

Several biological agents reduce spittlebug populations, but none has ever been considered effective in control. Eggs are attacked by two tiny wasps, *Ooetonus aphrophorae* Milliron and *Tumidiscapus cercopiphagus* Milliron, but known parasitization has not exceeded 5 percent. Flies have caused up to 50-percent parasitization of the adult spittlebugs, and adults and nymphs are occasionally preyed upon by ants, spiders, and birds. No parasites of the nymphs are known.

Cultural Control

Spittlebugs do not cause economic damage without alternate hosts and seldom become abundant unless the preferred alternate hosts—sweetfern or raspberry plants—are plentiful. Eradication of these perennials in established stands has not proved successful. Herbicides tested in sufficient quantities to kill the alternate hosts have also injured the pines.

Alternate hosts should be considered when planting sites are selected. Pines should be planted on sites best suited for them and where the other hosts are absent. Otherwise, trees should be planted the minimum acceptable distance apart

so that the ground vegetation will be shaded out early.

Chemical Control

Aerial and ground applications of malathion may be used to suppress the spittlebug. Malathion is recommended because it is an effective but nonpersistent chemical of low toxicity to humans and warm-blooded animals.

Large plantations and naturally occurring stands of infested trees should be treated by aircraft. Recommended dosage consists of undiluted 95-percent Malathion LV concentrate applied at the rate of 8 to 10 fluid ounces per acre. A solvent is not necessary if the aircraft is equipped with special low-volume spray nozzles. When special nozzles are not available, suppression is equally effective with 95-percent Malathion LV concentrate in a suitable solvent (Panasol AN-5 or equivalent). No. 2 fuel oil may be substituted, but it is less satisfactory and more volatile than commercial solvents. The recommended mixture contains 1 gallon of malathion in each 9.5 gallons of solvent, to be applied at the rate of 1 gallon per acre.

Small plantations can be sprayed effectively with a backpack mist-blower. Recommended mixture is one-half pint of 95-percent Malathion LV concentrate in 1 gallon of solvent (Panasol AN-5 or equivalent). Solution is applied at the rate of at least 1 gallon per acre. The mist should be aimed over the trees to prevent the solvent from burning the foliage.

Malathion in water or fuel oil may be effective too, but these formulations have not been tested. All malathion-based formulations should be mixed at the last minute to prevent chemical breakdown before use.

The spray program is timed to kill

the adult spittlebugs. Spraying is done in the short period after most of the adults have emerged but before egg laying. This period varies yearly and at different locations but is usually between the first and third weeks in July. Spray date can be projected from nymphal development; it usually should be 15 days after the peak of the fifth (last) nymphal stage. Development should be watched closely, however, because adult transformation may be retarded by cool rainy weather.

Caution: Malathion and other insecticides may be harmful to man and animals if applied improperly. Follow the directions and heed all precautions on the container label. Special caution is required when using concentrates: Wear rubber gloves and avoid contact with eyes, nose, mouth, and skin. After mixing chemicals or spraying, wash exposed body surfaces with soap and water. Change clothing if spray has been spilled on it and wash the contaminated area.

Avoid overdosing. Do not apply near or over streams, ponds, and lakes. Avoid drift of insecticide to nearby wildlife habitats, bee yards, crops, or livestock.

Store chemicals in plainly labeled containers out of reach of children, and where they will not contaminate food or feed. Destroy used containers.

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